

CLAIMS

1. A finger unit comprising:

a finger root part, a fingertip part, and a joint part for linking the finger root part and the fingertip part; wherein

5 the joint part supports the fingertip part revolvably around a joint axial line that is orthogonal to a center axis of the fingertip part;

the finger root part comprises a joint driving actuator for revolving the fingertip part around the joint axial line; and

10 the fingertip part comprises a revolving member that is supported in a revolvable state by the joint part, a rotating member that is supported in a state of rotation around the center axis of the fingertip part by the revolving member, and a rotation drive actuator for rotating the rotating member, wherein the rotation drive actuator is supported by the revolving member.

15 2. The finger unit according to claim 1, wherein

the joint part comprises a strain gauge or other torque sensor for sensing torque transmitted via the joint part.

3. The finger unit according to claim 1, wherein

20 the finger root part comprises a mounting flange and the joint driving actuator mounted on the mounting flange; and

the joint part comprises a drive-side bevel gear that is coaxially fixed in place at a distal end of a rotation output axle of the joint driving actuator, a pair of bearing housings that extend from a front surface of the mounting flange through both sides of the drive-side

bevel gear and protrude forward, bearings that are mounted in the bearing housings, a joint axle that is rotatably supported at both ends by the bearings and that is aligned in a direction orthogonal to the center axis of the rotation output axle of the joint driving actuator, a driven-side bevel gear that is coaxially fixed in place to the joint axle and that is meshed with the drive-side bevel gear, and a linking member that is fixed in place at one end to the joint axle and that extends in a direction orthogonal to the joint axle; wherein the revolving member of the fingertip part is linked to the linking member.

4. The multi-joint finger unit according to claim 3, wherein the joint axle is a hollow joint axle comprising a hollow part for wiring.

5. The finger unit according to any of claims 1 through 4, wherein the rotating member of the fingertip unit is a cylindrical outer casing of the fingertip part.

6. The finger unit according to any of claims 1 through 4, wherein a drill, driver bit, or other operating tool is coaxially mounted on the rotating member of the fingertip part.

7. A multi-joint finger unit comprising:
a finger root part, a finger intermediate part, a fingertip part, a finger-root-side joint part for linking the finger root part and the finger intermediate part, and a fingertip-side joint part for linking the finger intermediate part and the fingertip part; wherein the finger-root-side joint part supports the finger intermediate part revolvably around

a joint axial line that is orthogonal to a center axis of the finger intermediate part;

the finger root part comprises a finger-root-side joint driving actuator for revolving the finger intermediate part around the joint axial line;

the fingertip-side joint part supports the fingertip part revolvably around a joint axial
5 line that is orthogonal to a center axis of the fingertip part;

the finger intermediate part comprises a fingertip-side joint driving actuator for revolving the fingertip part around the joint axial line; and

the fingertip part comprises a revolving member that is supported in a revolvable state by the fingertip-side joint part, a rotating member that is supported in a state of rotation
10 around the center axis of the fingertip part by the revolving member, and a rotation drive actuator for rotating the rotating member, wherein the rotation drive actuator is mounted on the revolving member.

8. The multi-joint finger unit according to claim 7, wherein

15 the fingertip-side joint part and the finger-root-side joint part comprise a strain gauge or other torque sensor for sensing the torque transmitted via these joint parts.

9. The multi-joint finger unit according to claim 8, wherein

the finger intermediate part comprises a plurality of finger intermediate portions and
20 an intermediate joint part that links together the finger intermediate parts;

the intermediate joint part supports the intermediate portion nearest to the fingertip in a revolvable state around a joint axial line that is orthogonal to a center axis of the intermediate portion; and

the intermediate portion nearest to the finger root comprises an intermediate joint

driving actuator for revolving the intermediate portion nearest to the fingertip around the joint axial line.

10. The multi-joint finger unit according to claim 9, wherein
5 the intermediate joint part comprises a strain gauge or other torque sensor for sensing the torque transmitted via the intermediate joint part.

11. The multi-joint finger unit according to claim 7, wherein
the finger root part comprises a mounting flange and a finger-root-side joint driving
10 actuator mounted on this mounting flange; and
the finger-root-side joint part comprises a drive-side bevel gear that is coaxially fixed in place at a distal end of a rotation output axle of the finger-root-side joint driving actuator, a pair of bearing housings that extend from the front surface of the mounting flange through both sides of the drive-side bevel gear and protrude forward, bearings that are mounted in the
15 bearing housings, a joint axle that is rotatably supported at both ends by the bearings and that is aligned in a direction orthogonal to the center axis of the rotation output axle of the finger-root-side joint driving actuator, a driven-side bevel gear that is coaxially fixed in place to the outer peripheral surface of the joint axle and that is meshed with the drive-side bevel gear, and a linking member that is fixed in place at one end to the joint axle and that extends in a
20 direction orthogonal to the joint axle; wherein the revolving member of the intermediate part is linked to the linking member.

12. The multi-joint finger unit according to claim 11, wherein
the joint axle is a hollow joint axle comprising a hollow part for wiring.

13. The multi-joint finger unit according to claim 7, wherein

the fingertip-side joint part comprises:

5 a drive-side bevel gear that is coaxially fixed in place at a distal end of a rotation output axle of the fingertip-side joint driving actuator that protrudes from the finger intermediate part towards the fingertip;

a pair of bearing housings that are linked to the revolving member of the finger intermediate part and that extend through both sides of the drive-side bevel gear and protrude forward;

10 bearings that are mounted in the bearing housings;

a joint axle that is rotatably supported at both ends by the bearings and that is aligned in a direction orthogonal to the center axis of the rotation output axle of the fingertip-side joint driving actuator;

15 a driven-side bevel gear that is coaxially fixed in place to the outer peripheral surface of the joint axle and that is meshed with the drive-side bevel gear; and

a linking member that is fixed in place at one end to the joint axle and that extends in a direction orthogonal to the joint axle; wherein

the revolving member of the fingertip part is linked to the linking member.

20 14. The multi-joint finger unit according to claim 13, wherein

the joint axle is a hollow joint axle comprising a hollow part for wiring.

15. The multi-joint finger unit according to any of claims 7 through 14, wherein

the rotating member of the fingertip part is a cylindrical outer casing of the fingertip

part.

16. The multi-joint finger unit according to any of claims 7 through 14, wherein
a drill, driver bit, or other operating tool is coaxially mounted on the rotating member
5 of the fingertip part.

17. A multi-finger grasping mechanism having a plurality of finger units, wherein
each of the finger units is the finger unit according to any of claims 1 through 6.

10 18. A multi-finger grasping mechanism having a plurality of multi-joint finger units,
wherein
each of the multi-joint finger units is the multi-joint finger unit according to any of
claims 7 through 16.

15 19. The multi-finger grasping mechanism according to claim 18, comprising:
at least three of the multi-joint finger units; and
a common finger unit mounting plate on which the multi-joint finger units are
supported.